MAPES

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March 19, 1992

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Dear Mr. Radoff:

Thank you for your participation several months ago in INPUT's research on engineering and scientific applications. The results of the research have been published in a report, *Cross-Industry Markets, 1991-1996: Engineering and Scientific Sector* which is part of INPUT's Market Analysis Program.

Enclosed is a complementary copy of the report. If you have any questions, please do not hesitate to call.

Sincerely,

C. Frances Borison

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Senior Consultant

CFB:bf

Enclosure

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January , 1992

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Sincerely,

C. Frances Borison
Senior Consultant

Encl

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Market
Analysis
Program
(MAP)

Cross-Industry Markets 1991-1996

Engineering and Scientific Sector

INPUT®

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I

Introduction

I

Introduction

The engineering and scientific cross-industry sector report is written each year by INPUT as one of seven reports on cross-industry sectors of the U.S. information services industry. The seven cross-industry sectors are:

1. Engineering and Scientific
2. Accounting
3. Human Resources
4. Planning and Analysis
5. Education and Training
6. Office Systems
7. Other Cross-Industry

These reports are included as part of INPUT's Market Analysis Program (MAP), a planning service for information services vendors.

A

Purpose and Organization

1. Purpose

The objectives of this cross-industry report are to:

- Introduce the reader to the engineering and scientific cross-industry sector
- Identify the business and technological issues and trends that are driving the use of information services for the engineering and scientific cross-industry sector
- Forecast user expenditures during the next five years on information services for the engineering and scientific cross-industry sector
- Discuss the competitive environment and profile leading vendors in the engineering and scientific cross-industry sector

The report provides readers with insights and information that will help them:

- Review the forces shaping the market
- Develop internal corporate financial projections
- Identify new markets and product and services opportunities
- Assess the competitive trends
- Determine potential market directions
- Assist in prioritizing investments

2. Organization

This report is organized as described in Exhibit I-1.

EXHIBIT I-1

Cross-Industry Sector Report Format

I. Introduction
- Introduce and define each of the cross-industry sectors.

II. Trends, Events, and Issues
- An overview of the business climate within the cross-industry sectors and the information services industry as a whole.

III. Information Systems Environment
- The user perspective as it relates to information systems for the cross-industry sectors.

IV. Information Services Market Forecast
- Presentation of the information services market forecasts by delivery mode and submode for each of the seven cross-industry sectors.

V. Competitive Environment
- Discussion of the competitive environment for information services within each of the cross-industry sectors, and vendor profiles.

VI. Conclusions and Recommendations
- A summary of risks and opportunities.

A. Forecast Data Base
- Detailed forecast by delivery mode, submode and each cross-industry sector. Contains a reconciliation to the previous year's Appendix B for each cross-industry sector.

Note: For definitions, the reader is referred to INPUT's *Definition of Terms* found in the overview binder of the Market Analysis Program.

Chapters I, II and III are common to all cross-industry sectors. Chapters IV, V and VI are written specifically for each of the seven individual sectors. Appendix A, Forecast Data Base, is also provided specifically for each of the seven cross-industry sectors.

B
Definitions

This report addresses the U.S. information services industry for the engineering and scientific cross-industry sector. It includes user expenditures that are noncaptive (generally available to vendors). Many large organizations have portions of their information services requirements satisfied by internal divisions. The resulting expenditure is not available for competitive bid by the general vendor community and is not included in INPUT's projections.

1. Cross-Industry Sector Definitions

INPUT defines cross-industry information services as packaged functional application solutions that are used by multiple industry sectors. In other words, these application solutions are not verticalized. For example, accounting, and planning and analysis are functions that are similar enough across all industries to be considered markets in their own right for nonverticalized application solutions.

The engineering and scientific cross-industry sector encompasses the following applications:

- Computer-aided design and engineering (CAD and CAE)
- Structural analysis
- Statistics/mathematics/operations research
- Geographic Information Systems/Mapping

Computer-aided manufacturing (CAM) or CAD that is integrated with CAM is excluded from this report, as it is specific to the manufacturing industries. CAD or CAE that is dedicated to integrated circuit design is also excluded because it is specific to the engineering industry.

Structural analysis or finite element analysis helps engineers analyze the structural integrity and thermal inadequacies of components. A relatively new and developing market is electromagnetic field analysis, which analyzes the interaction between electronic fields. Examples of applications are:

- Aerospace—fuselage and wing internal load analysis
- Automotive—bumper impact analysis
- Defense—guidance system vibration
- Industrial machinery and mechanical design—gearbox and transfer case stress analysis

Statistical and mathematical analysis applications include all forms of survey analysis for market research and product testing, personnel evaluation, decision support, health care analysis and computer performance evaluation, and operations research. Specific examples include reviewing/analyzing data from accident reports; evaluating air traffic controller information; census data collecton; and monitoring of student performance, class selection and education testing.

Geographic Information Systems (GIS) and desktop mapping are finding a broad range of applications. GISs and mapping software capture, manage, analyze and display geographic information. Traditional uses include environmental monitoring, site planning and natural resource management. Utility and transportation firms are using GISs for facilities planning and management tasks, and government agencies are using GISs to manage public resources. Commercial applications include demographic market analysis to help, for example, retailers decide where to locate new stores; tax assessment; and routing of emergency vehicles.

2. Delivery Mode Definitions

Cross-industry application solutions are delivered via applications software products, turnkey systems and transaction processing services. Management support information services such as systems operations, systems integration and professional services, information delivery services, and systems software are excluded from cross-industry consideration.

a. Applications Software Products

Applications software products enable a user or group of users to support an operational or administrative process within an organization. Examples include accounts payable, order entry, project management and office systems. INPUT categorizes applications software products into two submodes.

- *Industry-Specific Applications Software Products* - Software products that perform functions related to fulfilling business or organizational needs unique to a specific industry (vertical) market and sold to that market only. Examples include demand deposit accounting, MRPII, medical record keeping, automobile dealer parts inventory, etc.

- *Cross-Industry Applications Software Products* - Software products that perform a specific function that is applicable to a wide range of industry sectors. Examples include payroll and human resource systems, accounting systems, word processing and graphics systems, spreadsheets, etc.

INPUT also forecasts the applications software products delivery mode by platform level: mainframe, minicomputer and workstation/PC.

b. Turnkey Systems

A turnkey system is an integration of equipment (CPU, peripherals, etc.), systems software, and packaged or custom applications software into a single product developed to meet a specific set of user requirements. Value added by the turnkey system vendor is primarily in the software and support services provided. Many CAD/CAM systems and small business systems are turnkey systems. Turnkey systems utilize standard computers and do not include specialized hardware such as word processors, cash registers, process control systems, or embedded computer systems for military applications.

Computer manufacturers (e.g., IBM or DEC) that combine software with their own general-purpose hardware are not classified by INPUT as turnkey vendors. Their software revenues are included in the appropriate software category.

Most turnkey systems are sold through channels known as value-added resellers.

- *Value-Added Reseller (VAR):* A VAR adds value to computer hardware and/or software and then resells it to an end user. The major value added is usually applications software for a vertical or cross-industry market, but also includes many of the other components of a turnkey systems solution, such as professional services.

Turnkey systems have three components:

- *Equipment* - Computer hardware supplied as part of the turnkey system
- *Software products* - Prepackaged systems and applications software products
- *Professional services* - Services to install or customize the system or train the user, provided as part of the turnkey system sale

c. Processing Services

This delivery mode includes three submodes: transaction processing, utility processing, and "other" processing services.

- *Transaction Processing* - Client uses vendor-provided information systems—including hardware, software and/or data networks—at the vendor site or customer site to process transactions and update client data bases. Transactions may be entered in one of four modes:

- *Interactive* - Characterized by the interaction of the user with the system for data entry, transaction processing, problem solving and report preparation; the user is on-line to the programs/files stored on the vendor's system.

- *Remote Batch* - Where the user transmits batches of transaction data to the vendor's system, allowing the vendor to schedule job execution according to overall client priorities and resource requirements.

- *Distributed Services* - Where users maintain portions of an application data base and enter or process some transaction data at their own site, while also being connected through communications networks to the vendor's central systems for processing other parts of the application.

- *Carry-in Batch* - Where users physically deliver work to a processing services vendor.

• *Utility Processing* - Vendor provides basic software tools (language compilers, assemblers, DBMSs, graphics packages, mathematical models, scientific library routines, etc.), generic applications programs and/or data bases, enabling clients to develop their own programs or process data on the vendor's system.

• *Other Processing Services* - Vendor provides service—usually at the vendor site—such as scanning and other data entry services, laser printing, computer output microfilm (COM), CD preparation and other data output services, backup and disaster recovery, etc.

For a more complete discussion of INPUT's information services industry structure and market sector definitions, please refer to INPUT's *Definition of Terms* found in the overview binder of the Market Analysis Program.

C
Related Reports

Related reports of possible interest to the reader include:

1. U.S. Markets

• *Cross-Industry Market Reports*
- Accounting Sector, 1991-1996
- Human Resources Sector, 1991-1996
- Planning and Analysis Sector, 1991-1996
- Education and Training Sector, 1991-1996
- Office Systems, 1991-1996
- Other Cross-Industry Sector, 1991-1996

- *U.S. Application Solutions Market, 1991-1996*
- *U.S. Processing Services Market, 1991-1996*
- *U.S. Industry Sector Markets, 1991-1996* (15 reports on all major industry sectors, e.g., insurance)

2. European Markets

- *The Western European Market for Computer Software and Services, 1991-1996*
- *Trends in Processing Services—Western Europe, 1991-1996*

II

Trends, Events, and Issues

II

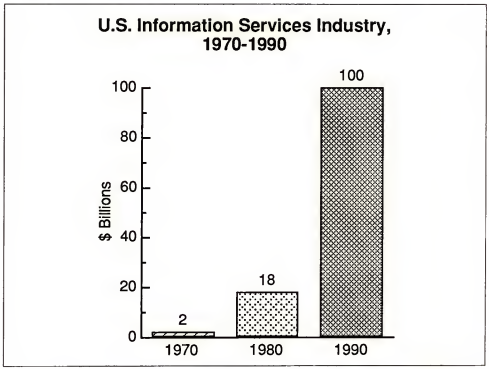
Trends, Events, and Issues

In this chapter INPUT provides an overview of the current business climate for the U.S. information services industry and for the delivery modes that comprise cross-industry application solutions. These are transaction processing services, applications software products and turn-key systems. The market forces and issues that are specific to this cross industry sector are dealt with in Chapters IV, V and VI of this report.

A
1990 Results

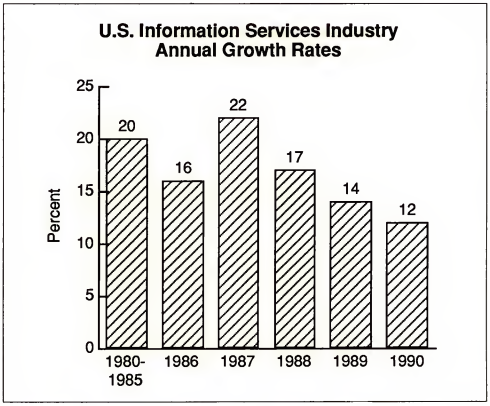
In 1990, the U.S. information services industry reached a milestone, ending the decade at about $100 billion in size. As Exhibit II-1 shows, the industry increased in size over five times during the 1980s and is 50 times larger than it was in 1970, when the industry represented $2 billion in user expenditures.

EXHIBIT II-1



During 1990, the industry grew at just under 12%—from about $90 billion to $100 billion. As Exhibit II-2 indicates, 1990 growth rates reflect an intensification of a decline that started in 1989. The average annual growth during the first eight years of the decade was over 19%.

EXHIBIT II-2



Worldwide, the industry continues to experience greater growth rates of close to 20%, and many U.S. vendors are experiencing growth that exceeds that of the U.S. industry as a whole. This growth is primarily due to international sales, but is also due to the focus on specific industry markets. Inflation rates and somewhat stronger economies are driving the industry to higher growth levels overseas.

On a delivery mode basis:

- The smaller systems integration, systems operations, and network services delivery modes are growing faster than the rest of the industry.
- The software products sectors grew at or slightly above the industry average.
- The larger professional services and processing services sectors, as well as the smaller turnkey systems sector, are growing slower than the industry average.

Exhibit II-3 summarizes 1990 results.

EXHIBIT II-3

U.S. Information Services Industry
1990 Results Summary

- Reached the $100 billion milestone
- Growth 2 to 3 times the economy continues
- Growth slowed in 1990 relative to 1989
- Economy causes confusion

Growth in transaction processing services sold to cross-industry sectors fell to a level of 7% in 1990—lower than the growth during any year in the past decade. In several cross-industry sector markets-office systems and planning and analysis-growth rates for transaction processing services have been negative for the last two years.

Although there was wide variation in growth rates among the cross-industry sectors, total growth for cross-industry applications software products was 12% in 1990 compared to 21% in 1988.

User expenditure on turnkey systems sold to cross-industry sectors was only 5% higher in 1990 than 1989 and will maintain a low growth rate through 1996. The only cross-industry sector exhibiting moderately strong growth was the engineering and scientific sector, with a 12% increase in 1990.

B
Driving Forces

There are a number of fundamental forces impacting the information services industry in the 1991-1992 timeframe that will have measurable impact on the overall growth rate for the 1991-1996 five-year period covered by this market analysis report. Each force will affect the industry as a whole, as well as each of the eight delivery mode sectors used by INPUT to analyze the industry and its key trends.

Exhibit II-4 identifies six primary driving forces impacting the U.S. information services industry. The impacts are multidimensional, fundamental, and long lasting. Each is discussed in this chapter and throughout this report.

EXHIBIT II-4

Information Services Industry
Primary Driving Forces, 1991-1996

- The economy
- Globalization
- Influence of large vendors
- Outsourcing (buy versus make)
- Shifting technology foundation
- The changing buyer

C
Key Trends

1. Economic Impacts

The economy, as well as the overall size of the information services industry, is a significant factor in the user expenditure level for information services and software products.

- The inflation rate of the past few years has been much more modest than in the mid-1980s. INPUT forecasts and market sizes are in current dollars—thus lower inflation means lower growth.

- Real economic growth had been modest over the past few years prior to the recession that started in late 1990. Deferred and canceled expansion plans in all industry sectors certainly slow the expansion of information services expenditures.

- The shift of information processing to smaller computers lowers the software products investment, based on current pricing practices. Quantities of software products sold increase, but revenue levels grow at more modest rates.

- The shift of information processing to smaller computers also puts price pressures on processing services firms, who must then compete with downsized in-house solutions.

In 1990, a year with little to no real growth in the overall economy and inflationary growth of about 5%, the information services industry grew 12%.

- INPUT's 1990 and 1991 economic assumptions were for nominal GNP growth of 5.4%; real GNP growth was 1% or less.

- At this point in 1991 (the fourth quarter), the economy remains in no-growth status, with some improvement expected by 1992. At the same time, inflationary pressures are modest. INPUT expects a modest growth year in 1991 and again in 1992. The expected slow upturn will have the following positive and negative impacts on the U.S. information services industry in the near term:

- Positive impacts include:

  - Increased motivation to buy rather than make, in particular for larger systems requirements. Response time and impact on business operations are the key criteria.

  - The interest in systems operations, which permits organizations to redeploy capital investments and lower direct headcount, is being reinforced.

  - A tight economy is helping develop interest in lower-cost solutions that come from client/server-based applications software products.

  - Decision processes are lengthened in a tight economy, causing deferral of major information systems projects.

  - With tight information systems budgets, the internal information systems staff can be favored over contracted professional services vendors, thus negatively impacting a major segment of the industry.

The purchase of processing services tends to be a long-term decision. Business levels of processing services are tied to client usage agreements and will not experience significant cutbacks due to fluctuations in the economy. An opportunity exists in the sale of incremental capacity to companies wishing to delay hardware expenditures.

Applications software products markets—both cross-industry and industry specific—have felt few if any of the effects of a slowed economy. The fact that hardware sales will slow further in the short term due to the economy is offset by pressure on profits at end-user organizations; expenditure on software that is viewed as improving productivity and/or cutting costs is likely to experience growth even with a weakened economy.

Turnkey systems vendors, however, are experiencing moderately adverse effects from the slowdown in the economy.

- Hardware purchases are put on hold—and hardware is a key ingredient of the turnkey solution.

- VARs and turnkey vendors that sell predominantly to small companies will experience the adverse effects of an economic downturn as smaller firms are the first to cut back on capital expenditures.

Turnkey and VAR service contracts and support services, however, have not been negatively impacted by a slowed economy. In fact, this portion of their business is expanding as customers look for ways to leverage the products they already have.

2. Globalization

INPUT has cited globalization as a driving force for the past three years. During that time markets have opened, vendors have expanded their international focus, and users have begun to expect global capabilities.

- The European market is making progress toward a single market. Now 1992 is less than a year away and many changes are apparent. In addition, the European market is stronger than the U.S. market, although both are suffering in the current economy.

- The worldwide orientation of the larger services vendors is verified by the investments in Europe by Computer Sciences Corporation and Digital Equipment and by the ever-expanding interest of Japanese vendors in the U.S. information services industry.

A high percentage of U.S. processing services firms' revenues is U.S.-based and is likely to remain so. For example, 95% of ADP's revenue is derived from the U.S. ADP is the largest transaction processing services firm, with revenues that are almost double the revenues of its nearest competitor.

Applications software products vendors, on the other hand, are rapidly expanding their revenues from non-U.S. sources. The following are notable examples of software firms expanding their presence in international markets:

- Computer Associates' net income from foreign operations was 28% of its total net income for 1990.

- Microsoft's international sales were 55% of total fiscal 1990 revenues.

- Oracle's international sales are now 49% of total revenues and edging up.

The largest turnkey systems vendors are also expanding their international presence. For example, Intergraph's non-U.S. revenues are now approaching 50% of total revenues.

The primary positive impact of globalization is the ability of larger vendors to balance their businesses in multiple markets with less impact from market downturns.

The primary negative impact from globalization is that it may make it harder for smaller vendors to grow and/or maintain independence.

3. Influence of Large Vendors

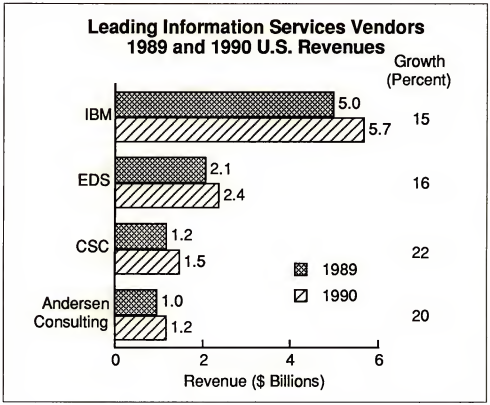
The influence of the larger information services vendors has increased significantly over the past few years.

- The newer systems integration and systems operations sectors, though smaller than more traditional sectors such as professional services and processing services, are growing faster than the traditional sectors and are dominated by the leading vendors.

- A number of larger vendors are growing faster than the overall market. Exhibit II-5 lists four of the largest information services vendors that can be considered multi- or full-service vendors and reveals their U.S. 1989 and 1990 information services revenues. All four increased information services revenues by at least 15%, greater than industry growth as a whole.

- Certainly there are numerous smaller firms that are also growing faster than the general market, but overall, the dominance of the larger vendors is increasing.

EXHIBIT II-5



Size is becoming more important, as a predictor of both survival and the level of support an applications software products or a turnkey systems vendor can deliver to its customers.

Although there are few barriers to entry in the software arena, it is questionable whether a small software company or VAR can remain viable without alliances. VARs and the smaller turnkey systems vendors are at a disadvantage in terms of geographic reach. They may have the best software for a specialized niche, but no way to expand their customer base; marketing alliances are a key requirement for growth.

Small companies can no longer expect to survive on their own in the long term. Such companies need a broader distribution reach, and the advertising, marketing and public relations that only a larger buyer can provide. Size alone provides far greater benefits to the business side of a software operation than it does to product idea generation.

The large-vendor influence is increasing in other ways as well.

- Starting with IBM, many large services vendors are making minority and majority investments to gain influence on technology, access to software products for remarketing, and market share.

- DEC's investment in Kienzle in Europe and EDS's investment in ASK Computer Systems are two examples of large vendors' seeking new channels and resources.

- As hardware profits decline, large hardware vendors are reorganizing in order to be more responsive to growing markets for software and services. DEC, for example, created its Software Products Group last year; and Sun has reorganized to create two software subsidiaries—one to develop more software and peripheral products and one to improve the UNIX operating system. IBM has also recently reorganized in order to grow its software and services business.

- Consolidation is also a factor. Mergers among the major accounting firms have reduced the number of players, but have given two of the firms (Ernst & Young and Deloitte Touche) added resources to follow the example of Andersen Consulting. A third—Price Waterhouse—is also experiencing significant growth in its information technology-based business.

Large transaction processing services vendors continue to acquire smaller regional and local firms, but not at the rate of previous years.

Applications software vendors will continue to consolidate as more emphasis is placed on integration and interoperability. Applications software products firms are not only acquiring each other, but are also acquiring firms that have new technology bases—such as transaction processing data bases and client/server CASE tools—that are of paramount importance to the growing need to develop better applications software products based on new technologies.

The increasing use of business consulting linked to professional services has provided a means for the large accounting and consulting firms, as well as some large information services firms, to gain a greater share of the industry. INPUT expects this trend to continue over the next few years. The opportunity for the smaller, more specialized software product or services vendors is not disappearing, but it is changing character.

- Alliances with larger vendors will be essential, at least as secondary sales and support channels.

- Specialization—in terms of the technology used or the industry served or both—will become more important and common.

This bodes well for turnkey systems vendors and VARs whose added expertise in vertical niches is the basis of their success. It also bodes well for continued growth in industry-specific applications software products. However, increasing emphasis on specialization will have a negative

impact on turnkey vendors who compete as cross-industry sector vendors. And provision of tools for easy customization and integration will become increasingly important to success for vendors with cross-industry applications software products.

The continuing increase in the strength and impact of the larger vendors will have the following positive and negative impacts:

- Positive impacts include:
  - The larger vendors have the financial strength to minimize the risk of systems management services.
  - The larger vendors have financial resources available to invest in new technologies, often through investment in smaller and specialized firms.
  - A common set(s) of standards are more likely—IBM's SAA and DEC's NAS for example—which will cause conformity in the marketplace, more consolidation, eventual interoperability and portability.
- Negative impacts include:
  - Alliances may become a requirement for smaller technology firms to survive and prosper.
  - The dominance of the larger vendors will continue to grow.
  - Larger vendors tend to move more slowly, which will hamper development and acceptance of new technology. This slowness will provide opportunity to small vendors that seize technology initiative.

4. Outsourcing (Buy versus Make)

Since its inception, the information services industry (services and software products) has tended to outgrow the internal information services budget by continuously creating new products and services that permit the information systems function to outsource (buy versus make). This has always been an outsourcing industry. And though growth has slowed, a number of factors will permit continued growth that exceeds growth in the economy, the computer hardware sector, and the internal information systems budget.

Key trends in outsourcing are listed in Exhibit II-6.

EXHIBIT II-6

Outsourcing:
Buy versus Make—Key Trends

- Systems management
- Solutions buying
- Applications maintenance
- Applications management

a. Systems Management

Outsourcing the management of information systems or at least significant elements of information systems continued to gain momentum during 1990. Helped more than hindered by the recessionary economy, the inclination of the general management of large organizations to consider outsourcing increased.

The ability to transfer much of the financial risk and, perhaps more importantly, the technological risk of a project or operations to a specialist has numerous attractions for general management.

- The attraction that will become more and more important will be the ability to disconnect the information technology part of the solution from the business decision. General management is concerned with business results and does not want to debate the pros and cons of a technology. The appeal of the vendor's offer to take on risk either in a project (systems integration) or in operations (system operations) can only grow during the 1990s.

- The nature of most outsourcing activities within larger organizations often makes them favor the large vendors, adding impetus to the trend described above. If there is major risk involved, the buyer will bet on the company most able to accept risk and take responsibility.

- Perhaps the most important attraction is the ability of buyers to gain access to a broad information technology on an arm's-length business basis in a single decision.

- The systems integration vendor can provide all the needed expertise in a new technology at the beginning of a project. There is no internal training lag time while the information systems staff gains the knowledge and experience required.

- The systems operations vendor can provide a full utility-based service at a predictable cost over a number of years. This should make for fewer surprises from the overall information systems program.

b. Solutions Buying

Buying applications software is a well-established practice in the U.S. market where the use of packaged software is commonplace. However, the current change in the way U.S. organizations are managed and the availability of low-cost, high-performance client/server computing is bringing new impetus to the application solutions market.

- The fundamental decentralization of U.S. business management with the corresponding reduction of corporate staffs is creating a major requirement for business unit (distributed) application systems. Furthermore, the buyer is not an information systems professional and is willing to outsource (buy) with some customization.

- Just when the smaller business unit needs independent application solutions, there is a hardware revolution to support the need. Client/server technology provides affordable, high-powered computing.

The ability to find a VAR that can provide a package plus customized systems on client/server-based software is bringing the solution value of systems integration to the decentralized business unit.

c. Applications Maintenance and Applications Management

In line with the shift to outsourcing systems management to systems integrators and systems operations firms, the buyer is also seeking to gain more-defined relationships with more-traditional professional services vendors. Instead of contracting for temporary personnel, the buyer is beginning to contract for services like applications maintenance and applications management.

- Applications maintenance is contracted, 24-hour support of existing applications systems. The vendor provides a set level of services and interacts directly with the end user.

- Applications management is contracted management of development and maintenance of a set of applications. The vendor provides the software and all of the expertise and staff to assure that the application is successfully used over an extended period. Applications software products firms can become applications management vendors for their clients or let some other vendor do it.

The trend toward outsourcing is creating new demand for the provision of additional services by applications software firms and turnkey systems vendors. Customers are beginning to want to pay vendors to maintain their software rather than hire their own people to do it. Increasing need for customization and integration is also creating new demand for outsourced services.

5. Shifting Technology Foundation

Significant new technologies became available in the late 1980s and are gaining momentum in the 1990s. An underlying characteristic of much of this new technology is a shift in the technological foundation. Many elements of technology are shifting to new foundations.

Exhibit II-7 lists the key elements of this shift in underlying technology. Each element is causing organizations to stop and rethink key aspects of their information systems infrastructure strategy. Rethinking can slow the adoption in the short term, and create new vendor opportunities over the longer term.

EXHIBIT II-7

New Technology Foundations

- International standards
- Graphical user interface
- Client/server
- Networking and integration
- Distributed data
- Imaging
- Engineered/re-engineered software

All of these new technologies and foundations cause confusion in the industry and with the buyer. Confusion slows buyers' and vendors' decision making. Strategies need to be revised and investment plans shifted, and education is required.

- Standards are driving every major computer manufacturer and software products developer to revise strategies and change product development plans. New products are delayed and then require longer initial sales introductions.

- The user interface of the personal computer in its graphical pull-down menu and windowing form will be the only interface acceptable to users from now on. The text-based interfaces of the 1970s and 1980s will no longer be tolerated. Every major software product developer is re-engineering the user interfaces to its products. The widespread availability of easy-to-use graphical user interfaces will promote the use of application solutions by the general user base and will allow for use of more application solutions—both industry-specific and cross-industry—per user.

- Downsizing, the common term for moving an application to a client/server-based installation, will be the greatest phenomenon of the early 1990s. Whether or not the installation is actually downsized, it will be moved to a new processing location and take on new characteristics. Major re-engineering of internal systems by the information systems function and a shift to buying server-based application products is under way. All of the impacts are not known. One, software products pricing based on the size of the platform, will have to change. Certainly some confusion exists and is impacting buying decisions.

- The growing use of PCs, workstations, and LANs has mandated a move to integrate the information networks of large and small organizations. Today's networking products permit the distributed applications that have been discussed for years but were never possible.

- The way data is stored and turned into information has been fairly constant since the creation of the first hierarchical DBMS in the early 1970s. Since then the challenge was to build data bases, not to consider building them with new types of components. The shift started with commercial use of relational DBMSs, but it is the distributed DBMS, and perhaps more importantly image processing, that will cause major re-engineering of the data base architectures of larger organizations. Major new investment is required and of necessity will come over time.

PCs, workstations, LANs, DBMSs, and client/server technology have a potentially negative impact on transaction processing services vendors. Though such technologies may slow the growth of "conventional" transaction processing services, vendors that can adapt to them will gain a market

advantage. The challenges faced may be similar to those that occurred when timesharing services matured and then declined as companies provided internal capabilities and the age of the personal computer began. Looking back at that period may help processing services vendors find opportunities in the age of client/server technology.

Cross-industry and industry-specific applications software vendors are scrambling to develop RDBMS-based products to compete in the 1990s marketplace. Oracle launched this trend with its cross-industry financial applications software products. Vendors are writing products using general SQL tools and are teaming with RDBMS companies such as Ingres, Sybase, Gupta and Oracle to make their application solutions available across a range of RDBMSs and hardware platforms.

Applications software products vendors as well as hardware vendors will look to third parties, including turnkey systems vendors and VARs, as a way to distribute their new technology-based solutions. VARs and turnkey vendors will increasingly need to develop technological expertise as well as integration expertise in order to keep pace.

- The age of truly engineered and re-engineered software through CASE technology is dawning. In five years the approach to maintenance will have finally changed and there will have been major advances in programmer productivity.

The positive and negative impacts of the shift in technological foundation are listed below. Certainly over the five-year period of this forecast the positives greatly offset the negatives.

- Positive impacts from this shifting technology foundation include:
  - New types of solutions will become available.
  - The role of the end user in information systems can continue to expand.
  - Opportunities for new as well as existing vendors are created.
  - Application systems can be increasingly molded to the character of the organizations they support.
- Negative impacts are:
  - Any shift causes confusion and hesitation in the near term. The magnitude of the current technology shift could cause confusion and slow investment through the middle of the decade.

- The size of the task to shift to client/server technology in organizations with large centralized systems causes conflicting priorities between re-engineering and meeting new requirements.

- The technology shift now in process is creating a significant additional training and education requirement.

- Growth is slowed while the new technology is understood and learned.

6. The Changing Buyer

The decision maker for the purchase of information services remained relatively constant until the late 1980s. The information systems executive and key staff (systems development and data center operations managers) decided when to go outside and with whom to contract.

This leadership has changed significantly in the past few years and promises to change even further. As integration becomes increasingly important the decision to purchase any given applications software product—be it cross-industry or industry-specific—will involve multiple departments/divisions and multiple levels of an organization. As the information services vendor moves to provide a full long-term service or a full solution, the general manager is becoming the buyer. The impacts are significant.

- Technology becomes less important and the business or operational impact becomes more important.

- The impact of the information systems function becomes more consultative and less direct.

- The ability to try new ideas and approaches is increased.

- The time to completion is controlled by the organization's ability to afford, not the ability of information systems to develop.

D
Summary

The year 1991 is exhibiting significant changes from the 1980s. The changes suggest more modest, but continued strong and stable growth for the information services industry.

- An economy that does not shift quickly helps management make longer term decisions, albeit at a slower pace.

- A market of $100 billion that is strongly impacted by the direction of the larger vendors should be expected to grow somewhat more slowly.

- The increasing tendency of larger organizations to turn to vendors for services that include real and significant elements of systems management and have a solutions orientation will lead to larger, longer term decisions—decisions that can take longer but have a lasting impact.

- The shift in the underlying technology foundation is for the better—more valuable and productive application solutions will result. But shifts bring re-engineering, reinvestment, and retraining, and require time and money.

- The role of the general manager concerning the deployment of information technology continues to increase. In many instances the general manager is more influential than the information systems manager, particularly regarding major decisions. Over time, the general manager's influence will have positive impacts on the size and growth of the information services industry—as long as the vendors provide satisfaction.

III

Information Systems Environment

III

Information Systems Environment

In order to better understand what was most on the minds of IS managers regarding applications software products, INPUT surveyed top computer executives in medium- to large-sized corporations. INPUT also conducted a series of telephone interviews with the respondents to obtain additional information about and clarification of some of the points in the written questionnaire. Turnkey systems and processing services were outside the scope of the survey.

The purpose of the questionnaire was to probe managers about specific areas of applications software products, such as their purchase plans, customization, product and vendor preferences, and key technology goals. INPUT was therefore able to test its previous conclusions about the marketplace as well as obtain additional insights.

Individuals completing the questionnaire were predominantly MIS directors and systems development and programming managers.

The views of 56 IS managers are tabulated and the results analyzed. Although large development budgets still exist, spending on packaged applications software products is healthy. Cross-industry products and products with little or no need for customization are generally preferred.

A
Demographics

Exhibits III-1 and III-2 show the distribution by vertical sector and revenues of the corporations that participated in the survey.

EXHIBIT III-1

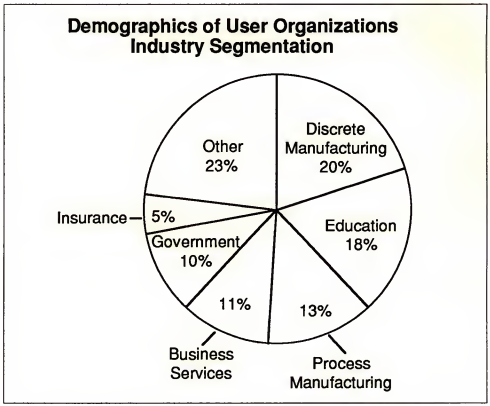
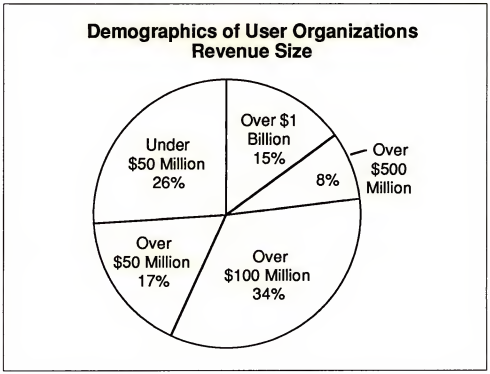


EXHIBIT III-2



- The mail survey included all industry segments. Industries with the greatest representation are: discrete manufacturing (20%), education (18%), and process manufacturing (13%). The largest sectors within the "Other" category—each consisting of about 5% of the survey sample—are transportation, retail distribution, and banking and finance.

- 15% of respondents have revenues over $1 billion; about 35% of the companies have revenues between $100 million and $500 million; 24% are between $50 million and $100 million in revenues; and 26% are under $50 million in revenues.

Although the sample represents a cross-section of vertical markets and company sizes, the survey results have been analyzed in total rather than by industry sectors or size groupings.

B

Applications Software Products Purchase Plans

Respondents were asked questions about overall budget size, cross-industry and industry-specific product spending, spending by platform size, and spending for new versus existing applications software products.

1. Budget Size

Exhibit III-3 shows the distribution of applications software products budgets.

EXHIBIT III-3

Applications Software Products Budget

Budget Size	Percent of Respondents
Over $1 million	2
Over $500,000	6
Over $250,000	13
Over $100,000	27
Under $100,000	52

- On average, the applications software products budget for 1991 is $291,000.

- The average budget will grow to $360,000 in 1992, a healthy 24% increase.

- The expenditure growth from 1991 to 1992 is higher than INPUT expected. The weak economy does not appear to have had a negative impact on applications software products expenditures for this survey sample. In fact, when questioned further, respondents indicated that the selective installation of new applications software products—including downsized solutions—is viewed as a means of minimizing corporate costs and improving productivity. Corporate restructuring through downsizing or acquisition also creates a need for new application solutions. Thus an economic slowdown enhances rather than inhibits applications software expenditures.

- Respondents were asked to indicate whether or not these amounts encompass all applications software packages purchased or licensed for their entire organization. If not, they were asked what percentage of total purchases they estimated the amounts to be. Respondents indicated that the figures given were about 70% - 80% of the total for their entire organization. The actual average budget for 1991 could therefore conceivably be in the $350,000-$400,000 range, growing to $430,000 to $500,000 in 1992.

2. Cross-Industry versus Industry-Specific

Respondents were asked to estimate the percent of budget spent on cross-industry and industry-specific applications software products. To assure accurate responses, INPUT's definitions of cross-industry and industry-specific applications software products were included in the questionnaire as follows:

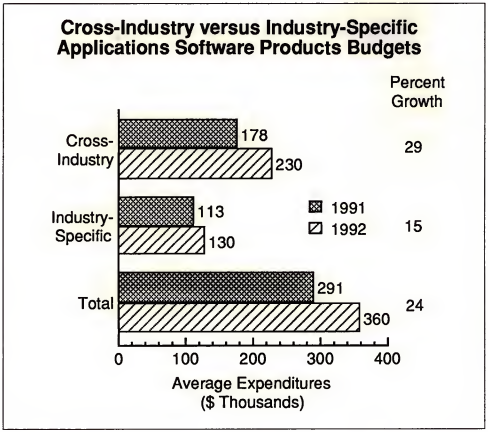
- Cross-Industry—Software products that perform a specific function applicable to a wide range of industry sectors. Examples are accounting, financial modeling, human resources, payroll, word processing, spreadsheets.

- Industry-Specific—Software products that perform functions related to solving needs unique to a specific vertical industry and sold to that industry only. Examples are portfolio management, MRPII, and medical record keeping.

- Data base management systems (DBMSs), graphical user interfaces such as Windows, and applications development tools, including CASE tools, are not considered applications software. Also excluded are processing services and network services.

Exhibit III-4 shows the respondents' average 1991 and 1992 budgets, broken out by these two categories.

EXHIBIT III-4



- Expenditures on cross-industry software do not only represent a higher percent of the budget; growth for 1992 is twice as high as for industry-specific software.

- Respondents with small or no industry-specific purchases had these comments:

  - They do not want to be locked into a specific solution they will have for years and are particularly reluctant to purchase industry-specific solutions, due to all the change under way in their industry as well as in the computer hardware and software industries.

  - Their needs are too specialized for industry-specific software and therefore they favor in-house development.

  - They want control over their software and want to be sure it can interoperate with what is already installed.

- The applications software selection for their type of hardware is meager.

- Too much customization would be required, which makes the software hard to maintain.

3. Expenditures by Platform Size

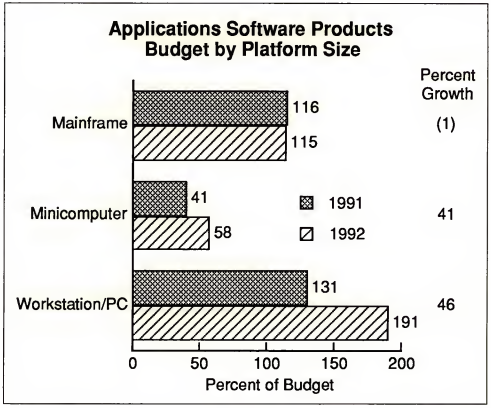
Respondents were asked to estimate the revenue percent split by platform size.

- As shown in Exhibit III-5, expenditure for applications software products that run on workstations and personal computers represents the largest proportion and is growing the fastest.

- Expenditure on minicomputer-based products represents the smallest proportion of the budget, but will be up 41% in 1992.

- Expenditures on mainframe-based applications software will be about the same in 1992 as in 1991.

EXHIBIT III-5



Respondents were then asked if the budget split by platform size is different for cross-industry and industry-specific applications software. Thirty-three percent indicated that the split was different, as shown in Exhibit III-6.

- For 33% of respondents, more is spent on cross-industry software for workstations and personal computers; and more is spent on industry-specific software for minicomputers.

EXHIBIT III-6

1991 Applications Software Products Budget by Cross-Industry/ Industry-Specific and Platform Size (33% of Respondents)

Platform	Percent of Respondents	
	Cross-Industry	Industry-Specific
Mainframe	45	46
Minicomputer	14	29
Workstation/PC	41	25
Total	100	100

Adding the responses of the 33% that said more is spent on cross-industry software for workstations/PCs (Exhibit III-6) to the 67% that did not notice any distinctions by platform size (Exhibit III-5) reveals the following (Exhibit III-7):

EXHIBIT III-7

1991 Applications Software Products Budget by Cross-Industry/ Industry-Specific and Platform Size (100% of Respondents)

Platform	Percent of Respondents	
	Cross-Industry	Industry-Specific
Mainframe	42	36
Minicomputer	14	21
Workstation/PC	44	43
Total	100	100

- For the survey sample as a whole, the only real distinction is that more industry-specific software is purchased for minicomputers; expenditures are 50% higher for minicomputer-based industry-specific software than for cross-industry software.

- For respondents in total, the split of cross-industry and industry-specific software running on workstations and personal computers is essentially the same.

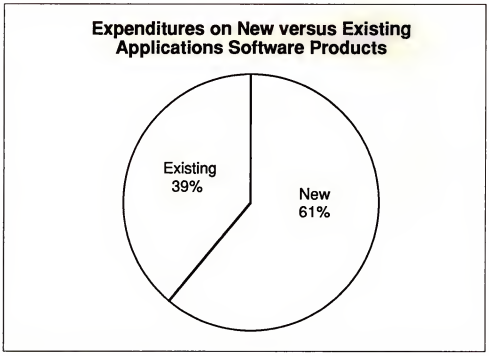
4. New versus Existing

Respondents were asked what percent was spent on new applications software packages versus maintenance and annual license fees for existing software. On average, 61% of their total 1991 budgets are for purchase of new applications software products and the remainder is for maintenance and annual license fees (Exhibit III-8). The percentage split is about the same for 1992.

- The percent spent on new purchases is noticeably higher than INPUT expected. Comparable INPUT data from other research indicates that this percentage is more in the range of 25%-30% spent on new applications software products and 70%-75% spent on maintenance/licensing fees.

- Plausible reasons for the seemingly high expenditure on new packages could be the continued shift towards PC spending and the significant number of small companies in the survey sample. Smaller companies are more likely to buy lower-cost software where maintenance costs are less significant.

EXHIBIT III-8



C

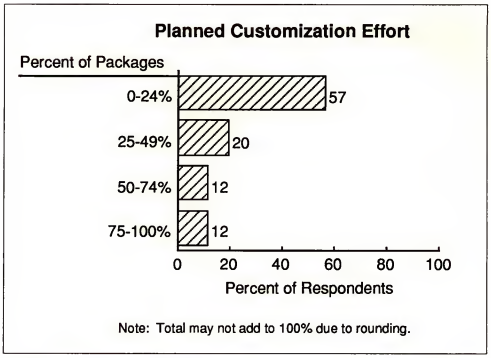
Planned Customization Effort

The question asked was, "Of all new applications software product purchases, what percentage of packages will you modify or customize?" The results are shown in Exhibit III-9.

- The majority of respondents will customize 25% or less of their purchases; only 12% of respondents will customize 75% or more of their applications software products. The average amount of customization is somewhere between 20%-30%.

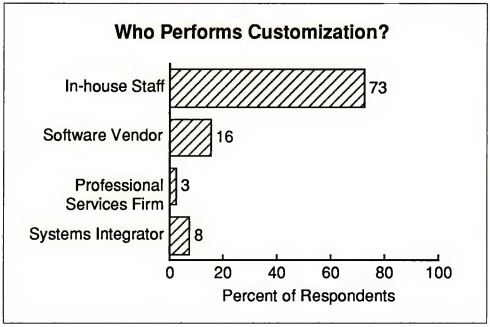
- Discussions with vendors reveal that vendors are increasing the customizability of their products and expanding their customization toolsets. Nonetheless, given responses to several of the other questions asked in this survey, users do not want to have to customize and they favor products that don't need it. In fact, as discussed in Section E below, easily customizable software is only a moderately important vendor selection criterion.

EXHIBIT III-9



- As shown in Exhibit III-10, of the customization that is performed, most is done in-house; only 25% is done by outside service vendors, including applications software firms. INPUT expects the amount performed by external service providers to increase.

EXHIBIT III-10



D

Total Applications Development Plans

- The average applications development budget for 1991 is $1.3 million, over four times greater than what is spent on packaged solutions. Therefore, even though purchase is on the increase, a great deal of applications development is still taking place.

- Overall, 52% of the budget is for enhancement/maintenance of existing systems and 48% is for development of new systems.

  - Responses ranged from a process manufacturer that purchases all of its applications software and a bank that purchases most of its software to a specialized business services firm that develops essentially all its company-specific applications software internally. The percent split may be dependent on vertical market and degree of need for specificity.

  - INPUT research in late 1990 indicated that 67% of budgets were for enhancement/maintenance and 33% for new development. Thus, the actual split may be about 60%/40%.

- Of the total applications development budget, an average of 63% is spent on internal development and 37% is spent on contracted professional services. Three respondents indicated that more than 70% of the total is spent on contracted services.

E

Product and Vendor Preferences

Respondents were asked to rank in order of significance seven specific reasons for purchasing new applications software products—1 being the most significant reason and 7 the least significant reason. Thus, a ranking of 3.5 indicates average significance within this set of criteria. The results are presented in Exhibit III-11.

- No single criterion ranked a 1, indicating lack of consensus about the single most important product selection criterion.

- New features are the most significant reason to purchase new applications software products and were rated 2.0 on average. For respondents, new features mean:

  - New functions not previously available and that they lack in-house expertise to develop

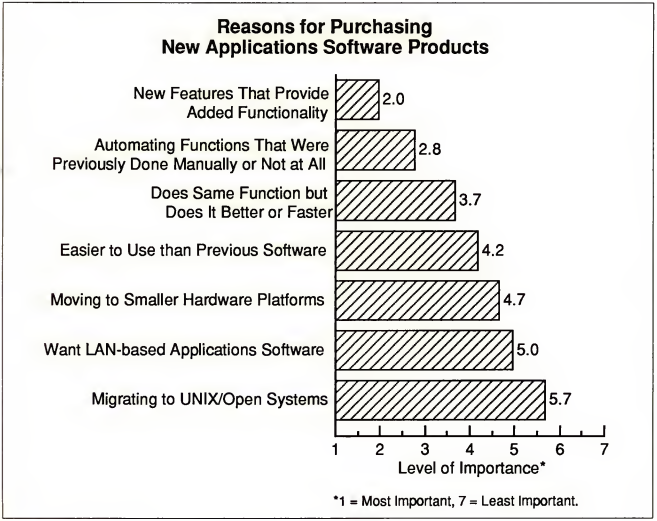
- Functions that decrease number of transactions necessary
- Portable across hardware platforms
- Expandability—meeting needs as company grows
- Interfaces to other application solutions

- Respondents ranked automating functions previously done manually as second in importance.

- The move toward smaller hardware platforms and the desire for LAN-based applications software ranked fifth and sixth of seven criteria. This is consistent with the relatively few mentions of downsizing and networking as key technology goals—23% and 27% of the respondents, respectively (see Section F below).

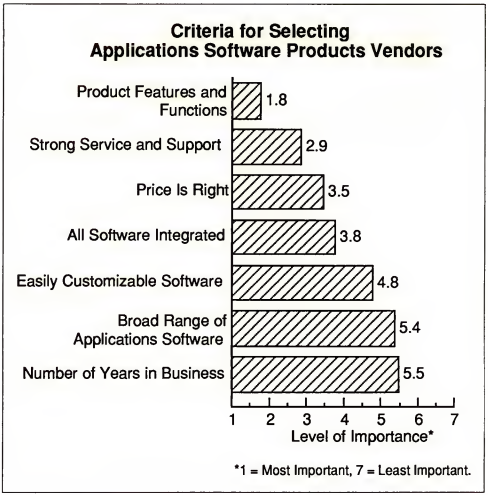
- UNIX/open systems ranks last as a reason to purchase new applications software products.

EXHIBIT III-11



Respondents were also asked to rank criteria in selecting an applications software products vendor, where 1 is the most significant/important reason and 7 is the least significant/important reason. The results are shown in Exhibit III-12.

EXHIBIT III-12



- The most important reason to select an applications software products vendor is the product features and functions, which is consistent with findings about reasons for purchasing a new product.
- Users are willing to pay more for not only features/functions but also strong service and support capabilities.
- It is interesting to note that integrated software is about in the middle (3.8) in terms of importance in selecting a vendor. This finding implies that for a product with new/better features and/or a vendor with strong service and support, users are willing to tackle integration themselves or hire someone to do it.

- For this survey sample, easily customizable software ranked only 4.8 in significance. This ranking implies that users do not customize purchased software to a large degree and is consistent with findings that, on average, users customize only between 20% and 30% of the applications software products they purchase.

- Given discussions with vendors, INPUT expected this ranking to be higher. Vendors are adding customization capabilities in hopes of expanding their market reach.

- A broad range of applications software from a single vendor is of less than average importance (5.4) as a vendor selection criterion. Clearly, users want to be able to choose from a variety of vendors; one-stop shopping for applications software is not critical.

- The number of years in business is ranked last as a vendor selection criterion.

These findings strongly suggest that room exists in the marketplace for new features/functions as well as for new vendors.

F
Key Technology Goals

Respondents were asked to list their three key technology goals over the next several years as they relate to applications software products. Similar goals are grouped into ten categories. Exhibit III-13 lists these categories and indicates the number of goals mentioned within each category.

- No category of goals was mentioned by more than 27% of respondents, indicating lack of consensus about technology directions over the next several years.

- Lower costs and improvement of overall productivity in a general sense is tied for first place as a key goal; it is assumed that this is the goal of all respondents, although not all of them mentioned it as a "technology goal."

- The two specific technology goals that came out on top are new or updated applications software and LANs/networking. Presumably they are viewed as key ways to lower costs and improve productivity. Each of these categories of goals was mentioned by 27% of the survey sample.

EXHIBIT III-13

Key Technology Goals

Category of Goals	Number of Responses
Lower Costs, Improve Overall Productivity	15
Install New/Updated Applications Software	15
LANs/Networking	15
Integration	13
Downsize Hardware/Software	13
Data Accessibility	12
Quick, Easy Applications Development	11
Ease of Use	9
Open Systems/UNIX	9
Other	4

- Although these findings cannot be used to forecast types of products that will be purchased, the following applications software product purchases/installations were mentioned: personnel/payroll/benefits, inventory management, financial systems, new banking applications, purchase order processing, office automation, warehouse management, process measurement, purchase request tracking, and point-of-sale systems.

- The technology goals of LANs/networking, integration, downsizing and data accessibility are interrelated. All enable users to access and share data and/or applications software products and resources more easily. About 45% of all mentions encompassed these four areas.

- It is interesting to note that these goals in fact precede faster/easier applications development. Quick/easy applications development is still among the top ten technology goals, but it is in the bottom third of the top ten. According to 1990 INPUT research, some of the approaches being used to control applications development resource consumption are: limiting resource allocation, purchasing packaged software products, re-engineering applications, and taking on maintenance-only functions.

- Three respondents mentioned EDI as a key technology goal.

- A variety of integration goals were mentioned, including:

  - Implement enterprise model
  - Integrate data bases
  - Operate over multiple platforms
  - Integrate applications
  - Link currently incompatible application systems

- Downsizing goals—mentioned by 23% of respondents—are evenly split between offloading the mainframe to minicomputers, workstations, PCs and PC-LAN configurations, and implementing client/server technology. Offloading the minicomputer was not mentioned.

- Data accessibility goals—mentioned by 23% of respondents—include more timely access to data, implementing EISs (executive information systems), improved ease of uploading to or downloading from the mainframe, easy-to-use reporting and query facilities, and implementing a DBMS.

- Faster/easier applications development was mentioned as a key technology goal by 16% of respondents. Examples of the kinds of goals related to development are:

  - Implement CASE (several mentions)
  - Reduce need for customization
  - Develop efficient development procedure
  - Obtain object-oriented DBMS

- Open systems/UNIX was mentioned as a technology goal by 16% of respondents, the same percentage as for improved applications development.

G
Survey Conclusions

Exhibit III-14 outlines the survey conclusions. A discussion of these conclusions follows.

EXHIBIT III-14

Information Systems Environment
Applications Software Products—Conclusions

- 24% budget increase planned for 1992 applications software products expenditures
- Mainframe-based spending declining; workstation/PC-based spending increasing
- More cross-industry spending
- Low level of interest in customization
- Large applications development efforts persist
- UNIX a low priority
- More functionality and features desired
- A variety of vendors preferred
- A variety of technology goals and approaches

On average, planned expenditures for next year will be 24% higher than for 1991. This is a healthy increase, more than INPUT expected. INPUT's five-year forecast—presented in Chapter IV, Information Services Market Forecast—considers the survey results as well as other factors and research data.

A weak economy does not appear to be dampening expenditure plans; on the contrary, it may promote expenditures as users look to applications software products as a way to reduce costs and improve productivity within their corporations. Purchases of applications software products are being closely scrutinized; products that obviously improve productivity will be purchased while sales of other "nice to have but not necessary" products will suffer.

Spending on applications software products for workstations and personal computers is growing the fastest; spending on mainframe-based products shows a decline. This pattern is the opposite of that shown in research on systems software products: for systems software products, mainframe-based expenditures are still the highest. This suggests that the mainframe as data repository for offloaded or downsized applications is viable.

The survey sample spends more on cross-industry applications software products—61% of the total budget and growing—than on industry-specific products. Several respondents expressed the concern that industry-specific software isn't specific enough for their needs and they don't want to have to customize the product. A reason for lack of interest in customizing is that customized products are harder to maintain. Another comment in favor of internal development as opposed to purchasing industry-specific software is the desire to maintain control over corporation-specific solutions.

Given some of these concerns, large applications development efforts continue in spite of vendors' efforts to make their products easier to customize. A dilemma for vendors is deciding what it will take to get users to purchase rather than develop; if they make their products more specific, the potential market size is limited. Vendors are responding to this challenge by not only adding customization and flexibility to their products but by providing services in support of users' development efforts. It would appear that the latter will provide the most immediate returns.

On the other hand, survey respondents expressed keen interest in products with new or better features and functions as well as products that can automate previously manual tasks. They want more specific products—that ideally require little or no customization—yet the profit structure of the industry may not provide much room for vendors to comply.

Integration of a vendor's applications software products and number of years in business are not high on the priority list of vendor selection criteria. This implies that being an established vendor is not necessarily a strong advantage in today's marketplace and that room exists for new market entrants. This may also imply added interest in turnkey vendors and VARs who can add specific functionality, and serve a smaller, specialized market.

Respondents indicated a wide variety of technology goals and approaches as they begin to shift along with shifting technology foundations. Foremost in their minds is to lower costs and improve corporate productivity. As expected, UNIX is a low priority; other frameworks such as SAA and NAS were not mentioned as (short-term) technology goals.

H
Turnkey Systems

Although the turnkey systems delivery mode was not included in this survey, it is included in this report as an application solution.

Generally speaking, turnkey systems—encompassing a total solution of software, hardware and service—are purchased for the fundamental purpose of running a business. In other words, the applications are, foremost, industry-specific production-level applications. For example, a law office will purchase a complete industry-specific accounting package that includes professional services billing, client disbursements, and client cost-tracking systems, which will be the mainstay of its business. A cross-industry human resources package will be a secondary consideration, the purchase decision typically being made after the turnkey solution has already been procured.

Thus—in contrast to applications software package purchasing patterns indicated by the survey results—the software emphasis for turnkey systems is industry-specific rather than cross-industry. Another obvious distinction is that far fewer turnkey purchases are mainframe-based.

I
Processing Services

According to separate market research findings, processing services will continue to exhibit some growth during the next five years, but growth will be selective, favoring certain markets and types of vendors. Processing services exhibiting the highest growth will be those that can be performed more economically by an outside services firm or those that organizations would like to offload because the procedures, updates, operational tasks and problem resolution are burdensome.

- The most common cross-industry processing service—payroll—may not cost less to run at a vendor's site, but clients feel that it is advantageous to have updates to tax tables, handling of checks, withholding and other payroll-related functions handled by an outside services firm.

- The quality of work is also a vital consideration for users. Providing the right application products and offering a competitive price will not offset late work, errors, or an inability to be responsive to inquiries and problems.

  End users are having more impact on the selection and use of information services, and they question why processing services vendors are not always responsive to opportunities such as:

  - Seeking additional opportunities for processing work with existing customers.

- Adding new applications or functions to their computing capabilities that would be useful to end users with workstation/PC resources, such as large-scale financial modeling or expert systems.

- Helping to move work in-house or to outsource in-house work.

Since there is more exploration of alternatives on the part of end users, processing services vendors must spend more time learning about and responding to the ideas of end users. According to respondents, the use of processing services will rise over the next several years but there will be more volatility in the market than previously experienced. Vendors will have to be more proactive in selling new accounts and holding on to existing ones.

IV

Information Services Market Forecast

IV

Information Services Market Forecast

This chapter presents user expenditure forecasts for engineering and scientific cross-industry information services by delivery mode. Assumptions driving the forecasts are provided. Information in this chapter draws on the trends, events, and issues presented in Chapter II, the user environment discussed in Chapter III, and the competitive environment which is discussed in Chapter V.

Note that these forecasts do not include industry-specific information services. The markets for these types of information services are presented in "industry-specific" MAP reports rather than the cross-industry reports.

Section A, Overview, discusses the overall size and growth rate of user expenditures for engineering and scientific cross-industry information services. Section B, Delivery Mode Analysis, breaks out this same forecast into INPUT's delivery modes. The delivery modes that are applicable to cross-industry sectors are:

- Applications software products
- Transaction processing services
- Turnkey systems

The following five delivery modes are not included in this cross-industry report:

- Network services
- Systems software
- Systems integration
- Systems operations
- Professional services

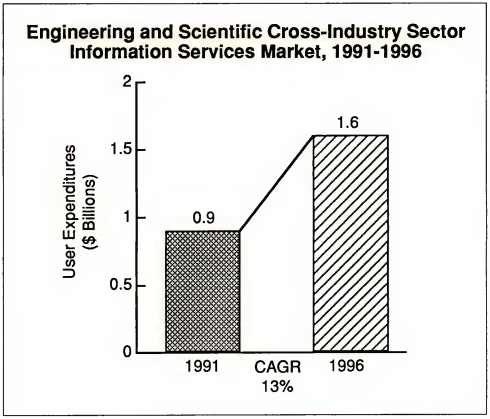
In addition, utility processing services and other processing services are excluded. These seven areas are discussed in several of INPUT's delivery mode reports.

A
Overview

Spending on engineering and scientific information services grew 10% in 1990, reaching $800 million. 1990 expenditures were slightly less than anticipated due to lower than expected expenditures on minicomputer-based applications software products.

Spending on engineering and scientific information services is forecast to grow at 13% compounded annually, reaching $1.6 billion by 1996 (Exhibit IV-1). This growth rate is just about the same as the compound annual growth rate (CAGR) for the information services industry as a whole (12%), e.g., expenditures on information services by all market sectors combined.

EXHIBIT IV-1



Although the engineering and scientific cross-industry sector is one of the smallest market sectors for information services as a whole, it nonetheless spends a larger dollar amount on applications software products than many of the industry-specific sectors, including process manufacturing, transportation, retail and wholesale distribution, and the federal government. Most of the expenditures and expenditure growth for the engineering and scientific cross-industry sector will continue to come from applications software products, primarily products that run on workstations and personal computers.

The driving forces and growth inhibitors for applications software products as a whole are listed in Exhibits IV-2 and IV-3 along with the impact they have on the engineering and scientific cross-industry sector.

EXHIBIT IV-2

Applications Software Products Driving Forces and Their Impacts on Engineering and Scientific Sector

Driving Force	Impact
New products	High
New technologies	Medium
Slowed economy/customer emphasis on productivity improvements	Medium
Pent-up demand for new products	Low

EXHIBIT IV-3

Applications Software Products Growth Inhibitors and Their Impacts on Engineering and Scientific Sector

Growth Inhibitor	Impact
Maturity of traditional products	High
Slowdown in hardware sales	High
New products still being developed	Low
Customer confusion	Low

Generally speaking, new hardware and systems software technologies will spawn new applications software products, which will fuel user expenditures. New personal computers and workstations based on more powerful microprocessors creates an environment for more sophisticated and more user friendly applications software products, including the incorporation of multimedia applications. Systems software products, such as operations management products that support the commercial UNIX environment, and network management tools will likewise create new opportunities for applications software products.

For the engineering and scientific cross-industry sector specifically, new product availability is opening up new markets that were previously untapped. Whereas for many other market sectors growth is fueled by new products to the same markets, for this cross-industry sector growth is fueled by new products to new markets.

New CAD, statistical, structural analysis and mapping products are appearing that take advantage of lower priced workstations and personal computers; previously these products only ran on mainframes and minicomputers.

- Smaller companies and a greater variety of companies are buying CAD. For example, interior designers who sell lighting fixtures or consultants who design swimming pools are beginning to use low-cost CAD.

- Users of statistical packages have historically been scientists and market researchers fluent in advanced statistics and who require programs that perform multivariate analysis, time series analysis, factor analysis, regression analysis and tests. Advanced statistical packages have programming languages to create statistical procedures as well as sophisticated diagnostic routines, but they are expensive and not user friendly. Now, however, statistical products are becoming more general purpose. General purpose, lower priced statistical software products are used when, for example, a need exists for more sophisticated analysis, greater data capacity or more specialized graph types than a spreadsheet can provide.

- In the 1970s the only users of structural analysis tools were companies that needed to conform to product safety standards. Now many different industries—from refrigerator to sporting goods companies—are using structural analysis tools to optimize designs and cut costs.

- Structural analysis software products are beginning to be used to view and analyze physical parts or objects during the manufacturing process rather than just viewing and analyzing the already completed object. Interest is also expanding in solving magnetic, electrical and electromagnetic problems.

- Vendors are introducing desktop mapping software with GIS-like layering features created specifically for business applications. For example, desktop mapping is used as a tool for identifying target markets and determining market penetration and potential.

  Desktop mapping for general business use primarily serves marketing and sales professionals across industries. It is viewed as a way to leverage data already sitting in company data bases; an estimated 75% of all data bases contain geographic data—an address or a zip code, for example.

Other examples of uses beginning to appear for desktop mapping include:

- Help a bank determine which branches are used most frequently, where existing ATMs compete with newly acquired ones, and which services are used most regularly
- Decide when and where to open a new retail outlet
- Assist in locating potential customers and plot regional sales strategies
- Public and private administrators use them for projecting the best locations for new stores or offices and for allocating resources among facilities.

INPUT does not consider developments in UNIX to be a significant growth promoter for the engineering and scientific sector because this sector has always been strongly UNIX-based. This is not to say that UNIX does not have an impact; the impact is that vendors in this cross-industry sector must port their products to an increasing array of versions of UNIX and stay abreast of developments in open systems and standards, which creates more strain than growth.

Although, as indicted in Chapters II and III of this report, expenditures on applications software products have been generally immune to the economic downturn, the engineering and scientific sector is having a mixed reaction to the slowed economy.

It is true that customers emphasize their needs for productivity improvements during times of slow economic growth, and selective installation of new applications software products—including engineering and scientific software—is viewed as a means of minimizing corporate costs and improving productivity.

On the other hand, universities and research organizations have been hard hit by the economy. As academia/research has always been one of the largest markets for statistical software, it is also having a negative impact on vendors of statistical application solutions.

Additionally, turnkey systems vendors and VARs have felt a negative impact on the economy as hardware expenditures are curtailed. Also, much of their sales are to smaller firms, which are often the hardest hit in a recession.

Although pent-up demand for new products is a driving force for applications software products expenditures in general, it is not a driving force for the engineering cross-industry sector specifically. UNIX availability is already high; vendor software frameworks such as SAA and NAS are seemingly unimportant for this cross-industry sector; and standards are far in the future and are a constant source of aggravation for both vendors and users—but this is nothing new.

The whole of the applications software products market may be suffering from maturation in a general sense. During the 1980s reasonably good applications software products were an obvious improvement over former, typically manual ways of performing a task and were enthusiastically embraced with little questioning. Today, however, large users already have some software solution in place. Within the engineering and scientific sector, this is especially true for CAD products.

CAD has historically sold at a premium, but now the industry is under pressure not only to continue to add new features and functions but also to sell CAD at a lower price. The CAD/CAE market today is predominantly an upgrade and replacement market.

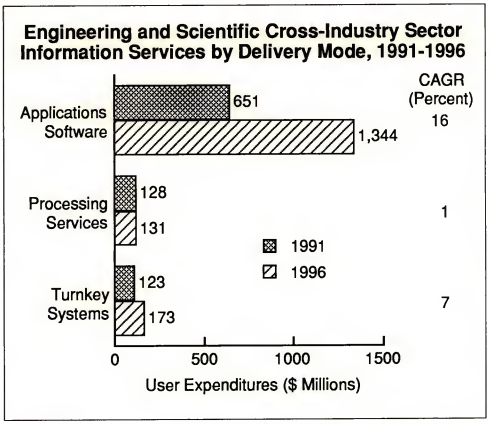
Customer confusion and the fact that new products are still on the drawing boards are not negative influences for the engineering and scientific sector. Client/server products are on the drawing boards but the fact that they're not available yet does not appear to be a growth inhibitor. Software frameworks such as IBM's SAA are not a factor because engineering and scientific applications have yet to become mainstream corporate applications. And UNIX has already been embraced by this sector.

What is a negative force, however, is the fact that missionary selling is required in order to penetrate new markets. As one vendor put it, "It takes an outside force to get a new industry interested in statistical analysis software." Most general business professionals do not understand statistics and how it applies to them. Nor is the general business market yet aware of the benefits of desktop mapping.

B
Delivery Mode Analysis

As can be seen from the forecast presented in Exhibit IV-4, 1991 expenditures on applications software products will be well over twice as large as expenditures on the other two delivery modes combined. By 1996, applications software products expenditures will tower over expenditures on the other two modes by more than a factor of four.

EXHIBIT IV-4



Following is a discussion of each of the individual delivery mode forecasts.

1. Applications Software Products

Applications software products for the engineering and scientific sector are forecast to grow at a CAGR of 16%, which is slightly higher than the 14% CAGR for applications software products expenditures for all market sectors combined. The reason for this slightly higher CAGR is the availability of new and lower priced products with broader appeal. This broader appeal will enable engineering and scientific applications software products to transcend their originally intended markets.

INPUT's estimate of the 1991 applications software products market by application type is presented in Exhibit IV-5. Statistics, CAD/CAE and GIS/mapping are all approximately the same size. Structural analysis is the smallest application type; most structural analysis applications software is industry-specific, even more so than for the other three application areas.

EXHIBIT IV-5

Engineering and Scientific Cross-Industry Sector Applications Software Products Market by Application Type and Platform Size

Application Type	User Expenditures ($ Millions)
Statistics	190
CAD and CAE	176
Structural Analysis	95
GIS/Mapping	190
Total	651

Structural analysis and mapping products are expected to show the strongest growth over the next five years, followed by statistical and CAD/CAE software, which will experience more difficult selling environments.

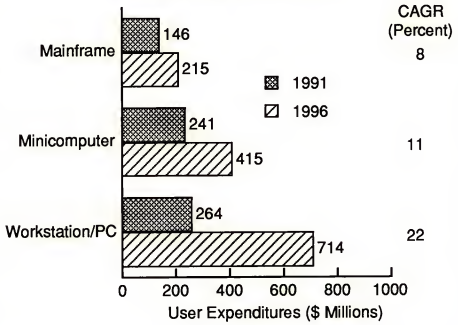
INPUT's estimate of the 1991 applications software products market and forecast by hardware platform is presented in Exhibit IV-6.

Exhibit IV-6 reflects the following:

- Mainframe-based engineering and scientific software is forecast to grow at a slightly higher rate than the overall industry CAGR for mainframe-based applications software products (8% compared to 6%).
- Over 50% of expenditure for GISs is still for mainframe-based products which have traditionally served cartographic, earth resources, and other scientific areas. Large government and commercial enterprises use GISs on mainframes and will continue to license upgrades.
- Workstation- and PC-based CAD now accounts for an estimated two-thirds of CAD expenditures.

EXHIBIT IV-6

Engineering and Scientific Cross-Industry Sector Applications Software Products Market by Platform Size, 1991-1996



- Growth in statistics software has shifted to the PC level due to the emergence of 80286 and 80386 microcomputers. Windows will promote growth in the statistical software market; windows-based products will be forthcoming in 1992.

- The area of desktop mapping is a recent development, brought about not only by the proliferation of computer power at the desktop, but also by the increasing availability of geographic data bases and the ability to add street maps.

  - TIGER (Topologically Integrated Geographic Encoding and Reference file) is a detailed computerized map of the entire U.S. TIGER is a seven-year, $200 million project that lists in digital form every highway, street, bridge and tunnel in the 50 states. It can be combined with a data base such as the results of the 1990 census or a company's own customer files.

    With complete national coverage, TIGER is acting as a catalyst for growth in GIS and desktop mapping. Although use is not by any means widespread, the Census Bureau provides TIGER files on magnetic tapes for mainframes and on compact discs (CD ROM) for PCs. The Census Bureau has opted to leave development of applications software to the private sector—and companies have moved quickly to create value-added products and services.

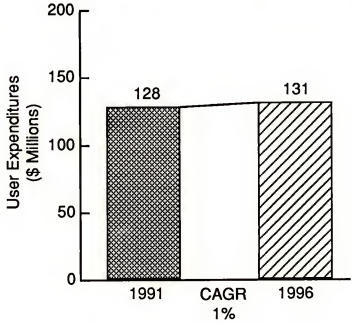
- The market for structural analysis applications software products at the workstation and PC level is still small, but product availability is increasing.

2. Processing Services

Exhibit IV-7 presents INPUT's transaction processing services forecast. The need for engineering and scientific processing services—albeit a small need—may be curtailed as some funding of large research projects is put on hold.

EXHIBIT IV-7

Engineering and Scientific Cross-Industry Sector Processing Services Market, 1991-1996



Users of processing services are universities and research organizations, and industrial companies that do not have the computer power in-house to run sophisticated engineering and scientific applications. SPSS-X is available as a batch-oriented system for data analysis that appeals strongly to academic researchers, particularly in the social sciences.

Although INPUT does not expect mainframe pricing to decline measurably, price/performance ratios continue to improve for minicomputers and especially workstations/personal computers; statistical packages that were previously available only for large computers can now run effectively on the desktop. This phenomenon will limit growth of expenditures on engineering and scientific processing services to research organizations and companies with large ongoing sophisticated computing needs or companies that need a temporary solution to their computing needs.

INPUT does not expect the trend toward outsourcing to have a noticeably positive impact on processing services for this cross-industry sector.

This processing services forecast is considerably lower than the overall processing services forecast for all market sectors combined (8%). In addition to this, INPUT has lowered its forecast this year for engineering and scientific cross-industry processing services expenditures. Processing services vendors do not generally publicize engineering and scientific services; Boeing Computer Services has exited the market. As mentioned previously, the negative impacts of the continued economic slowdown will curtail academic and scientific research budgets.

3. Turnkey Systems

Turnkey systems in this cross-industry sector are predominantly CAD; mapping turnkey solutions are also available. Roughly 46% of expenditure is on the hardware content and 40% of expenditure is on the software content of turnkey systems. Therefore the kinds of driving forces and trends impacting both hardware and software directly impact turnkey systems.

As hardware becomes lower cost and more standard, turnkey systems vendors will be forced to add value in other ways such as through additional new technologies, more professional services, and customization. Continued expenditure on turnkey systems is dependent on this additional value being made available.

EXHIBIT IV-8

Engineering and Scientific Cross-Industry Sector Turnkey Systems Market, 1991-1996

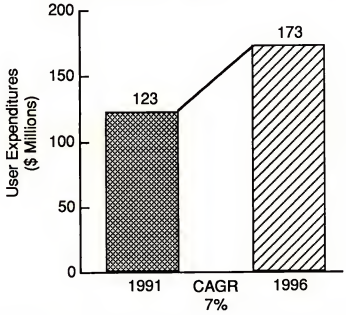


Exhibit IV-8 reflects the following:

- This forecast is slightly lower than the overall turnkey systems forecast for all industry and cross-industry sectors combined (7% compared to 9%).

- The original CAD vendors addressing this cross-industry sector were turnkey vendors, providing what were, at the time, specialized engineering workstations and applications software solutions. Now, however, turnkey vendors are pressured into developing increasingly portable software and not tying their products to a single platform. As CAD software and data base technology has grown in importance compared to hardware technology, many of the original CAD turnkey vendors have been forced to exit this market.

- Limited growth is still available to CAD turnkey systems vendors and VARs as some products are sold to increasingly smaller companies. Opportunities arise for VARs to add technology such as output tools, other cross-industry applications software packages that tie into CAD, special streaming devices, and network software as a bundled solution.

- Desktop mapping vendors are expanding their VAR channels in efforts to expand their markets. However, they are seeking industry-specific VARs such as those that service the retail, medical, and insurance markets.

V

Competitive Environment

V

Competitive Environment

This section discusses the competitive environment for information services within the engineering and scientific cross-industry sector. Key trends and vendor reactions to these trends are discussed. Leading and emerging vendors are identified and profiled.

A

Vendor Characteristics and Trends

1. Open Systems and Standards

Open systems and standards are having the following kinds of impacts on vendors in the scientific and engineering cross-industry sector.

- UNIX is having a big impact on these vendors, as it is where the growth for many of their products lies. Vendors need to be able to port to dozens of platforms in order to succeed. This development activity takes time and money, and is taking its toll on the smaller vendors.
- The search for standards for multivendor design environments continues.
- Windows-based products will be in demand in the future. Motif and Open Look will also continue to be widely supported.

CAD especially has become a tough market, due to slower growth rates and to the development costs necessary as workstations and standards "waver" under software. Companies must be careful not to spread costs/efforts too thinly as UNIX versions and "standards" multiply.

2. CAD Consolidation and Diversification

Within the last few years a number of significant CAD acquisitions have taken place, shown in Exhibit V-1. The strong competitors of several years ago—Calma, Versacad, Computervision, and Gerber Systems—have significantly lessened their presence in or have exited the market.

EXHIBIT V-1

Engineering and Scientific Cross-Industry Sector Significant CAD Acquisitions

Company	Acquired by
Applicon	Schlumberger
CADAM	IBM
Calma	Computervision
Computervision	Prime
Versacad	Prime

Although most of the consolidation has already happened, several acquisitions have recently taken or are about to take place:

- Calay Systems was acquired in July 1990 by Siemens AG.
- EDS has announced intentions to acquire McDonnell Douglas Systems Integration Co. after a bid to buy just the company's CAD/CAM software line was rejected. Its Unigraphics CAD software is one of two preferred CAD systems in use at EDS' General Motors Corp. parent. In addition to Unigraphics, McDonnell Douglas markets GIS, records management software and CAE products.

Given the consolidation that has occurred in CAD and the fact that vendors are continuing to exit, stability/long-term viability is becoming more of a concern and a purchase criterion for users.

Due to increasingly mature market conditions, continued growth for CAD vendors is often through diversification efforts. For example, Autodesk has personal computer multimedia software and hypertext filing and retrieval software product offerings (Xanadu subsidiary).

CAD companies, as well as statistical software vendors, are also continuing to expand their foreign presence; 55% of Autodesk's revenue now comes from non-U.S. sources, up from 48% just two years ago. Foreign markets for statistics software are also not as heavily penetrated as U.S. markets. SPSS' revenues from non-U.S. sources has grown to 40% of total annual revenues.

3. New Marketing and Distribution Methods

Smaller platforms and lower priced software opens up new market opportunities and allows for deeper penetration of already existing markets. Thus application solutions vendors must sell more product in order to make a profit. In order to sell more product they need to seek out alternative marketing and distribution channels, as direct sales become increasingly cost prohibitive.

Products are beginning to be distributed through marketing alliances between vendors with complementary products. For example, SPSS, as a leading vendor of statistical analysis software products, resells MapInfo's desktop mapping products. Integration of products that enhance one another—graphics with statistics, for example, or structural analysis with CAD—will enhance their usefulness and salability.

Missionary selling is required in order to penetrate new markets. As one vendor put it, "It takes an outside force to get a new industry interested in statistical analysis software." Most general business professionals do not understand statistics and how it applies to them. Nor is the general business market yet aware of the benefits of desktop mapping.

Thus a transition is underway in the industry structure. This transition will take time and will put a cap on new market growth in the short term.

B
Leading and Emerging Vendors

Computer-aided design and engineering—Over 100 companies participate in the CAD market; however, few participate in the scientific and engineering cross-industry sector due to the continuing trend towards specificity and customization. Of those vendors that do participate in automated cross-industry design and drafting, a continuing shakeout and redefinition is under way.

The strong competitors of several years ago—Calma, Versacad, Computervision, and Gerber Systems—have significantly lessened their presence in or exited the market. Most of the companies lessening their presence are turnkey providers who based their software products on a certain hardware architecture. When the era of the workstation arrived, they were wed to the then old hardware and unbundled/transitioned awkwardly.

Because IC and systems design is outside the scope of this report, companies such as Cadence Design Systems, Dazix, Mentor Graphics and Valid Logic, all of which sell the vast majority of their products to engineering companies, are excluded from this discussion.

Structural analysis—At least 100 companies offer structural analysis programs, the vast majority of which have niche products for primarily niche markets; a very small part of their business is cross-industry.

Statistics/mathematics/operations research—Vendors providing statistical and mathematical analysis application solutions have for the most part added modular capabilities and broadened their product lines; now statistical analysis is supported as one of many operations. Several hundred statistical applications software products exist for the PC but only about half a dozen of the companies that make them have revenues over $5 million. Many of these companies will go as quickly as they come.

A critical question that remains is whether companies offering statistical packages only will be able to survive in a market looking for more integration of tools. Today the specialized company must sell directly to the sophisticated, larger user who is willing to perform the tool integration task himself. The specialized company can also sell its tools via OEM agreements to the broad-line vendor that, in turn, provides the integration task.

In addition to National Science Foundation (NSF) Supercomputer Centers, dozens of regional remote supercomputing centers exist with time available to outside users. Many license applications packages for structural design, simulation and analysis. Processing services firms such as Litton Computer Services, Computer Sciences, Control Data and GE Information Services may offer timesharing services in statistical applications; however, statistical processing services are a small and diminishing portion of their overall business.

GIS/Mapping—GIS use has not expanded over this last year as was anticipated. What has blossomed, however, is interest in desktop mapping. A handful of vendors have desktop mapping product offerings; more are expected to enter.

Today's leading cross-industry engineering and scientific vendors are listed in Exhibit V-2. With the exception of Intergraph, they are software-only vendors whose products run on industry standard platforms. Although no new entrants in the CAD arena are expected, vendors will continue to enter statistics, structural analysis and mapping.

EXHIBIT V-2

Engineering and Scientific Cross-Industry Sector Leading Vendors

Vendors	CAD/ CAE	Structural Analysis	Statistics/ Mathematics/ Operations Research	Mapping
Autodesk	X			
Auto-Trol	X			
BMDP			X	
CADAM (IBM)	X			
Caliper				X
Cosmos		X		
Engineering Mechanics and Research Corp.		X		
Environmental Systems				X
Intergraph	X			X
MacNeal-Schwendler		X		
MapInfo				X
SAS Institute			X	
SPSS			X	
Strategic Mapping				X
Structural Dynamics Research Corp.	X			
Synercom				X
Swanson Analysis		X		
Unigraphics (McDonnel Douglas)		X		

C
Vendor Profiles

This section contains profiles of a sampling of leading vendors to show diversity of types of companies and approaches.

Boeing Computer Services (BCS), profiled in last year's report, exited the commercial processing services business and is therefore not profiled this year. BCS is now concentrating its efforts on products and consulting services that enhance its parent Boeing company. BCS continues to market Easy5, an engineering software tool for dynamic modeling, nonlinear simulation, and control system analysis and design applications, and will continue to enhance this product.

1. Autodesk, Inc., 2320 Marinship Way, Sausalito, CA 94965, (415) 332-2344

Autodesk is the market share leader of cross-industry microcomputer-based CAD software and has continued to grow even though the market and many of its vendors are faltering.

Autodesk, incorporated in December 1982, designs, develops, markets and supports a family of computer-aided design and drafting (CAD) software products for microcomputers and 32-bit workstations. Autodesk offers low-cost, easy-to-use CAD packages that run on virtually all computers supporting MS-DOS, Apple Macintosh II computers, and on certain engineering workstations supporting UNIX.

Sales are primarily through dealers to a broad market including mechanical, structural and electrical engineers; architects; facilities planners; technical illustrators; interior designers; surveyors; electronic system designers; and educators.

Although its main thrust continues to be cross-industry CAD, through a separate division AutoDesk is pursuing the chemical and bio-engineering markets with a new molecular modeling software product, HyperChem.

In 1990, Autodesk entered the multimedia market with Autodesk Animator for the IBM PC. It is sold primarily to business professionals, video professionals, and educators who need to create impressive video presentations.

Fiscal 1990 revenues were $237.9 million, up 33% from 1989 revenues.

2. Auto-trol Technology Corporation, 12500 North Washington Street, Denver, Colorado, 80241-2404, (303) 452-4919

Founded in the 1960s as Automated Controls (making controls for bakery ovens), Auto-trol ventured into CAD in the early 1980s. Originally CAD only, the company has now broadened its software product offerings; its three key markets are:

- AEC and facilities management (System 5000)
- Mechanical design (System 7000)
- Electronic publishing

System 5000 is a high-end cross-industry mechanical CAD package used to design a wide range of objects such as buildings, pipes, and equipment. A facilities manager or a designer, for example, can view a floor from different angles using System 5000 3-D capabilities and ascertain how much room remains on the floor of a plant to run vehicles through the plant. System 7000, primarily purchased by the discrete manufacturing sector, is a mechanical CAD system. Series 7000 Advanced Graphics Software is also for three-dimensional modeling.

Auto-trol ported its key products to UNIX in 1990. Products run on Sun, DEC and HP/Apollo workstations. PCs are supported minimally for engineering viewing and mock-up only.

Auto-trol is strengthening its position as a systems integrator and provider of support services, in addition to continuing its thrust as a software developer and VAR.

Auto-trol's customers include petroleum, pharmaceutical and chemical companies; architectural and engineering firms; construction contractors; aerospace companies; federal, state and local governments; retail merchandisers; public utilities; and manufacturers of industrial and consumer products.

Fiscal 1990 (year ending 9/30/90) revenues were $79.5 million, up 3% from fiscal 1989 revenues.

3. CADAM (IBM), 1935 N. Buena Vista Street, Burbank, CA 91504, (818) 841-9470

CADAM is a general purpose CAD product for mechanical drafting. It is positioned as a productivity tool rather than a highly featured design tool. CADAM was originally designed in the 1960s and used by Lockheed. The product and the company was spun off as a separate subsidiary in 1982 and was acquired by IBM in January 1990.

CADAM offers a wide range of CAD software that runs on PCs. Products are sold exclusively by IBM and through VARs. IBM also sells Dassault Systems' Catia CAD package and a version of SDRC's CAD package.

Sales this year have been buoyed by CADAM and Catia releases for the RISC System/6000 workstations and servers.

CADAM employs between 700 and 800 people.

4. Intergraph Corporation, Huntsville, Alabama 35894-0001, (205) 730-2000

Intergraph is a turnkey supplier of systems that support design, drafting and analysis functions. Intergraph workstations and servers are based on a common hardware platform and run under Intergraph's UNIX-based operating system. All software is therefore compatible across models.

The platform is a workstation family based on its own RISC Clipper microprocessor. Intergraph purchased the manufacturing rights to the Clipper chip from Fairchild Semiconductor Corp. when National Semiconductor bought Fairchild in 1987. INPUT believes it will become more difficult for Intergraph to sell these systems in a market that will increasingly favor open systems and standards.

Intergraph has a marketing alliance with Informix whereby Intergraph sells Informix' RDBMS products. Intergraph products are integrated and based on the Informix RDBMS. Intergraph also resells Oracle and ASK/Ingres RDBMS products.

In late 1990 Intergraph acquired Dazix/Cadnetix, Inc., a supplier of electronic design automation software. This year Intergraph entered into an agreement with Sun Microsystems whereby Sun's SPARC systems will be resold with the Dazix software. Intergraph may have to expand the role of Sun's platforms for its turnkey systems for broader, long-term appeal.

Intergraph offers a broad array of interactive graphics software applications—more than 750 programs. This software includes a significant number of packages developed by third parties, some but not all of which are in the engineering and scientific cross-industry sector. Application areas are:

- Electronics design and manufacturing
- Mechanical design, engineering and manufacturing
- Electronic publishing
- Scanning and document management
- Architectural and engineering design
- Civil engineering
- Plant design

- Electrical design and engineering
- Utilities
- Geographic information systems
- Surveying and cartography
- Energy exploration and production
- Dispatch management

Because the trend toward systems with higher performance and lower prices is continuing, and because Intergraph is a turnkey supplier, the company must continue to sell its products in higher volumes and at lower cost in order to maintain or exceed historical revenue levels.

Fiscal 1990 revenues (year ended December 1990) were $1,044.6 million, up 21% over the previous year's revenues. Net income decreased 21%.

5. The MacNeal-Schwendler Corp., 815 Colorado Blvd., Los Angeles, CA 90041-1777, (213) 258-9111

MacNeal-Schwendler (MSC) was incorporated in California in 1963 as an engineering professional services company. Beginning in 1966, MSC was a major contributor to the development of NASA's NASTRAN, a general purpose structural analysis computer program based on the finite element method. In 1971 MSC began offering its own proprietary enhanced version of NASTRAN under the name MSC/NASTRAN. Thus NASTRAN has been in use and refined over a 20-year period—an extraordinary product life for any software program.

NASTRAN provides analysis capabilities for almost every kind of structure and is used by a wide variety of industries. NASTRAN has been used to model forces and stresses; material plasticity; critical loading factors; shock and seismic properties; subsonic and supersonic flow; combined structure and fluid effects; magnetic fields in and about ferromagnetic bodies; flutter analysis; and much more. NASTRAN runs on supercomputers, minicomputers and workstations. Although some sales are cross-industry—such as to utilities and universities—the majority of sales are to discrete manufacturing industry sectors.

In addition to MSC/NASTRAN, MSC offers finite element analysis programs that run on IBM PCs and compatibles: MSC/pal 2 for stress and vibration analysis and MSC/cal for heat transfer analysis. MSC/pal is also available on the Apple Macintosh.

Over the last two years, MSC has acquired Noetic Technologies, Inc. and PISCES International B.V. Noetic's product is MSC/PROBE and PISCES' product, now MSC/PISCES, has a package for the analysis of high-speed elastoplastic and hydrodynamic phenomena.

MSC's 1990 fiscal year revenues were $45 million, up 13% from 1989. More than 89% of its revenues consist of rents and royalties paid by clients for use of the company's software products. MSC also provides analysis and software development services.

6. McDonnell Douglas Systems Integration Co., 325 McDonnell Boulevard, Hazelwood, MO 63042, (314) 232-0232

In August of this year, EDS announced intentions to acquire McDonnell Douglas Systems Integration Co.

This publicly held subsidiary of McDonnell Douglas Corp. has three divisions: manufacturing and engineering, infrastructure solutions, and industry information services. Revenues for calendar 1990 were $407 million, up 16% from 1989.

Approximately 33% of total revenue comes from the sale and maintenance of packaged software.

In North America, McDonnell Douglas reported packaged software revenues of $88 million in 1990, up 7% from the previous year. The company's international "sister" company, which handles all packaged software outside North America, recorded revenues of $44 million.

The heart of its information systems business is CAD/CAM work. Unigraphics was originally developed internally to design the company's airplanes. In addition to the Unigraphics family of CAD software, the firm's products include Stradis, a structured analysis tool available for the PC; ProKit Workbench, a CASE tool; and the Graphics Design System (GDS).

In addition to software, the company provides services that include outsourcing, systems life cycle methodologies, and professional consulting. It is one of the top ten systems integrators in the United States and serves such diverse industries as manufacturing, telecommunications and insurance.

7. SAS Institute, Inc., SAS Circle, Box 8000, Cary, NC 27512-8000, (919) 677-8000

SAS's stated philosophy is to provide a variety of tools for accessing, managing, analyzing and presenting data for a wide variety of applications. SAS has historically dominated, and still dominates, the statistical analysis software market for mainframes and minicomputers; it is also a leader in PC-based statistical analysis packages.

SAS—along with its competitor SPSS—has announced it will provide support for IBM's Information Warehouse framework, a way in which IBM intends to help users organize and manage their data, positioning the mainframe as the conduit and access point to multiple data bases residing on multiple platforms.

SAS System, the Institute's flagship product, is an integrated applications software system for data access, management, analysis and presentation. SAS now has over a dozen modules for its original SAS System, including:

- Statistical analysis
- Project management
- Quality improvement
- Experimental design
- Critical path
- Mathematical programming
- Time series analysis
- Forecasting
- Quality improvement

In recent years SAS has moved from the statistical realm into project management, quality improvement, experimental design, and clinical and pharmaceutical software for data analysis. SAS/PH-Clinical software is the company's first product targeted to a specific industry.

Because of the variety of its products and markets, SAS has varying lists of direct competitors. Because of its EIS orientation, SAS is also represented in the planning and analysis cross-industry sector.

SAS System runs on mainframes, minicomputers, UNIX-based workstations, and PCs. One of SAS's goals is to provide completely portable software. MultiVendor Architecture (MVA) is a term used to describe the structural design of the SAS System. First conceived in 1984, MVA provides a software architecture that maximizes the SAS System's ease of migration from one operating environment to another. With MVA, the SAS System runs the same across all environments SAS software supports. The institute's decision to rewrite the entire SAS System in the C programming language helped initiate its move to MVA.

8. SPSS, Inc., 444 N. Michigan Ave., Chicago, IL 60611, (312) 239-2400

SPSS, a leading statistical data analysis software company, develops and markets data entry, data management, statistical analysis and presentation software that operates on most models of all major computers. Its flagship product runs on over 40 mainframes, minicomputers and PCs. It provides

over 50 statistical processes, including regression analysis, correlation, and analysis of variance. Applications include all forms of survey analysis for market research and product testing, personnel evaluation, decision support, health care analysis and computer performance evaluation.

SPSS, originally named Statistical Package for the Social Sciences, was written by Norman Nie, a professor at Stanford University. In 1976, Nie formed SPSS, Inc.

SPSS is a statistical data analysis system used for a range of statistical applications. The package contains more than 50 statistical procedures, on-line help, a statistical glossary, and extensive data management capabilities.

- SPSS/PC+ is the company's statistical data analysis system for microcomputers.
- SPSS also runs on OS/2 and Macintosh. These products have the same functionality of SPSS for mainframes, minicomputers and workstations.
- SPSS/PC+ Studentware is a floppy-disk-based system specifically designed as a tool for teaching statistics and data analysis across a variety of disciplines.

SPSS uses RS/6000 workstations to build and maintain the source code that is used in all versions of its software products for computers ranging from MS-DOS-based PCs to Cray supercomputers.

In early 1992, SPSS will introduce a new generation of highly interactive statistical software products for graphical environments. It is also developing a family of applied statistics products for nonstatisticians and is enhancing customer support and consulting activities.

SPSS 1990 revenues were $34 million, up 13% over 1989 revenues.

Whereas SAS' strategy is diversification into a wider variety of analysis tools, SPSS will remain targeted in the general statistical arena.

9. Swanson Analysis Systems, Inc., P.O. Box 65, Houston, PA 15342, (412) 746-3304

The ANSYS product is a general-purpose, finite element computer program for engineering analysis that includes pre-processing, solid modeling, analysis, post-processing, analysis, post-processing, graphics and design optimization. The code is used for solutions to mechanical, thermal and electronic problems.

The ANSYS program is noted for its nonlinear analysis capabilities such as nonlinear material behavior, which encompasses plasticity, creep, swelling and nonlinear elasticity. It is used in many industries including aerospace, automotive, construction, electronics, medical, metals, power generation, offshore structures, packaging, railroad and transportation. It operates on 386-based personal computers as well as workstations, minicomputers and mainframe computers. Swanson Analysis' annual revenues are in the $35 million to $50 million range.

VI

Conclusions and Recommendations

VI

Conclusions and Recommendations

A

Industry and IS Market Conclusions

The delivery modes that are analyzed and forecasted for the cross-industry sectors are applications software products, turnkey systems and transaction processing services. Taken together, the growth rate of user expenditures on these three delivery modes by the engineering and scientific cross-industry sector will be about the same as for the IS industry as a whole. Within each delivery mode there is some variance, however, as described below:

- Expenditures on applications software products are forecast to grow at a slightly higher CAGR (16%) than the industry average (14%). The primary reason for this higher growth is that new products—available now—are beginning to penetrate new markets. This activity will increase over the forecast period.

- In many of the other sectors, new products—based on new technologies such as UNIX and client/server architectures—are not yet widely available; users are waiting rather than purchasing. For the engineering and scientific sector, however, UNIX-based products have been widely available for some time; and client/server architectures will only provide a small incremental increase in expenditures.

- Turnkey systems for the engineering and scientific sector are forecast to grow at a slightly lower CAGR (7%) than the industry average (9%). The reasons are that CAD, which historically was one of the strongest turnkey systems/VAR markets, will increasingly be sold as applications software products only, due to hardware standardization and price cutting.

- Processing services for the engineering and scientific sector are forecast to grow at a considerably slower CAGR (1%) than that of the industry as a whole (8%). The primary reason is that engineering and scientific applications software products are available on affordable platforms, so essentially all work will be brought in-house. Additionally, the traditional purchasers—universities and research organizations—are experiencing budget constraints that will be felt for a long time to come.

B

User and Vendor Issues and Recommendations

Exhibit VI-1 summarizes INPUT's overall recommendations to users and vendors in the engineering and scientific cross-industry sector.

EXHIBIT VI-1

Engineering and Scientific Cross-Industry Sector User and Vendor Recommendations

- User Recommendations
  - Test new products that capitalize on existing corporate data bases
  - Understand integration need
- Vendor Recommendations
  - Assure high feature/function content
  - Form alliances
  - Gain alternative distribution channels

Engineering and scientific applications software products have recently become available to general business users, whereas before they were the sole domain of engineers and scientists. The usefulness and validity of these products need to be explored and tested by the user community. The ways in which these products can be integrated and used with already existing applications software products and data bases also need to be assessed. Engineering and scientific applications software products may be tools that can add value and usefulness to existing corporate data bases. One area in which desktop mapping and statistics software, for example, is proving particularly useful is in sales and marketing organizations.

Within the IS industry as a whole, integration—hardware and software interoperability—is an increasingly important concern. The advantages of specific applications within the engineering and scientific sector will be multiplied if the various application areas can be integrated with one another. For example, statistical and mapping applications software products lend themselves to working effectively together as a single solution for data analysis and graphical presentation; so do CAD (or CAD/CAM) and structural analysis tools. Vendors may want to seek out alliances so that they can effectively sell integrated solutions.

For the more mature application areas such as CAD, vendors are under constant pressure to provide new and better features and functions as well as lower priced solutions. These two seemingly conflicting user demands create challenges for vendors, including seeking out ways of reducing costs in all areas of business. We can expect to see increasing sales through the dealer channel as the cost structures continue to shift.

"Nice to have but not necessary" products will suffer. Vendors must assure that the features/functions they introduce enhance user productivity. For CAD, it may be 3-D design techniques; however, the level of market demand for 3-D remains questionable.

A challenge for vendors of statistical applications software products is to continuously show more people how the product can be beneficial. Missionary selling is required in order to educate the general business user on the usefulness of statistics products. Ease-of-use issues and support issues are relevant when selling to less experienced users.

It goes without saying that vendors should not explore or offer new or additional engineering and scientific processing services as there is no growth here; vendors will continue to emphasize other processing services.

Turnkey vendors and VARs will continue to be used as a channel for this cross-industry sector as emphasis is increasingly placed on alternative distribution channels. However, INPUT believes that the strategy of choice will be to target specific industries such as medical, insurance and the pharmaceutical industries—which means that the activity is no longer considered cross-industry.

Appendix

A

Forecast Data Base

Exhibit A-1 presents the detailed 1991-1996 forecast for the engineering and scientific cross-industry sector.

EXHIBIT A-1

Engineering and Scientific Cross-Industry Sector User Expenditure Forecast by Delivery Mode, 1990-1996

Delivery Mode	1990 ($M)	Growth 90-91 (%)	1991 ($M)	1992 ($M)	1993 ($M)	1994 ($M)	1995 ($M)	1996 ($M)	CAGR 91-96 (%)
Sector Total	799	13	902	1,012	1,136	1,281	1,449	1,648	13
Processing Services	123	4	128	129	129	130	131	131	1
-Transaction Processing	123	4	128	129	129	130	131	131	1
Turnkey Systems	112	10	123	134	144	153	159	173	7
Applications Software	564	15	651	749	863	998	1,159	1,344	16
-Mainframe	135	8	146	157	170	184	199	215	8
-Minicomputer	211	14	241	272	303	338	375	415	11
-Workstation/PC	218	21	264	320	390	476	585	714	22

Exhibit A-2 presents the forecast reconciliation for the engineering and scientific cross-industry sector.

INPUT's estimated 1990 expenditures for applications software products have been reduced due to slower than anticipated growth in minicomputer-based applications software products.

EXHIBIT A-2

Engineering and Scientific Cross-Industry Sector
1991 Data Base Reconciliation

Delivery Mode	1990 Market				1995 Market				90-95 CAGR per data 90 rpt (%)	90-95 CAGR per data 91 rpt (%)
	1990 Report (Fcst) ($M)	1991 Report (Fcst) ($M)	Variance from 1990 Report ($M)	Variance from 1990 Report (%)	1990 Report (Fcst) ($M)	1991 Report (Fcst) ($M)	Variance from 1990 Report ($M)	Variance from 1990 Report (%)		
Total	817	799	-18	-2	1,489	1,444	-45	-3	13	13
Processing Services	123	123	-	-	150	131	-19	-13	4	1
Turnkey Systems	112	112	-	-	159	159	-	-	7	7
Applications Software	582	564	-18	-3	1,180	1,159	-21	-2	15	15

About INPUT

INPUT provides planning information, analysis, and recommendations for the information technology industries. Through market research, technology forecasting, and competitive analysis, INPUT supports client management in making informed decisions.

Subscription services, proprietary research/consulting, merger/acquisition assistance, and multiclient studies are provided to users and vendors of information systems and services. INPUT specializes in the software and services industry which includes software products, systems operations, processing services, network services, systems integration, professional services, turnkey systems, and customer services. Particular areas of expertise include CASE analysis, information systems planning, and outsourcing.

Many of INPUT's professional staff members have more than 20 years' experience in their areas of specialization. Most have held senior management positions in operations, marketing, or planning. This expertise enables INPUT to supply practical solutions to complex business problems.

Formed as a privately held corporation in 1974, INPUT has become a leading international research and consulting firm. Clients include more than 100 of the world's largest and most technically advanced companies.

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